

FORM PTO-1500 (Modified)  
(REV. 11-98)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371**

**HER0046**

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

INTERNATIONAL APPLICATION NO.

**PCT/FR99/02705**

INTERNATIONAL FILING DATE

**November 5, 1999**

PRIORITY DATE CLAIMED

**May 12, 1999**

TITLE OF INVENTION

**WIND MACHINE WITH SLANTED BLADES**

APPLICANT(S) FOR DO/EO/US

**MARCEL LENABOUR AND CHRISTOPHE HAGOPIAN**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
  - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

**Items 13 to 20 below concern document(s) or information included:**

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

**Formal Drawings  
Publication No. WO00/70219 in English  
Application Data Sheet**

HER0046

Page 2 of 2

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

<i>Group</i>		}	<u>Certificate Under 37 C.F.R. 1.10</u>
<i>Art Unit:</i>	Unknown	}	"EXPRESS MAIL" MAILING LABEL NUMBER
		}	EL731384517US
<i>Attorney</i>		}	DATE OF DEPOSIT <u>JUNE 20, 2001</u>
<i>Docket No.:</i>	HER0046	}	I HEREBY CERTIFY THAT THIS PAPER OR FEE IS BEING
		}	DEPOSITED WITH THE UNITED STATES POSTAL SER-
<i>Applicant:</i>	Marcel LeNabour et al.	}	VICE "EXPRESS MAIL POST OFFICE TO ADDRESSEE"
		}	SERVICE UNDER 37 C.F.R. 1.10 ON THE DATE
<i>Invention:</i>	WIND MACHINE WITH SLANTED BLADES	}	INDICATED ABOVE AND IS ADDRESSED TO THE ASSIS-
		}	TANT COMMISSIONER FOR PATENTS WASHINGTON, DC
		}	20231
<i>Serial No:</i>	Unknown	}	on <u>JUNE 20, 2001</u>
<i>Filed:</i>	Herewith	}	
<i>Examiner:</i>	Unknown	}	

*Michelle L. Neal*  
Michelle L. Neal

PRELIMINARY AMENDMENT

Box Patent Application  
Assistant Commissioner for Patents  
Washington, DC 20231

Sir:

Prior to the examination of the above-identified application, please amend the application as follows:

IN THE CLAIMS

Please amend Claim 3 as follows:

3. (Amended) Wind machine as claimed in claim 1, characterised in that the aerodynamic nose (20) is provided with a wind inlet orifice (35) communicating, on the one hand, with a water-separating enclosure (37) and, on the other hand, with ducts (38, 39) for guiding air cooling the electric power circuits.

Please amend Claim 4 as follows:

4. (Amended) Wind machine as claimed in claim 1, characterised in that at its upstream end contiguous with the rotating hub (7), the hood (9) is extended by a gutter (40) penetrating the interior of the latter to collect rain water.

Please amend Claim 7 as follows:

7. (Amended) Wind machine as claimed in claim 5, characterised in that the upstream end of the hood (9) contiguous with the rotating hub (7) is extended by a gutter (40) penetrating the interior thereof for collecting rain water.

Please add new claim 12 as follows:

- - 12. Wind machine as claimed in claim 2, characterised in that the aerodynamic nose (20) is provided with a wind inlet orifice (35) communicating, on the one hand, with a water-separating enclosure (37) and, on the other hand, with ducts (38, 39) for guiding air cooling the electric power circuits.- -

Please add new claim 13 as follows:

- - 13. Wind machine as claimed in claim 2, characterised in that at its upstream end contiguous with the rotating hub (7), the hood (9) is extended by a gutter (40) penetrating the interior of the latter to collect rain water.- -

Please add new claim 14 as follows:

- - 14. Wind machine as claimed in claim 3, characterised in that at its upstream end contiguous with the rotating hub (7), the hood (9) is extended by a gutter (40) penetrating the interior of the latter to collect rain water.- -

Please add new claim 15 as follows:

--15. Wind machine as claimed in claim 6, characterised in that the upstream end of the hood (9) contiguous with the rotating hub (7) is extended by a gutter (40) penetrating the interior thereof for collecting rain water.- -

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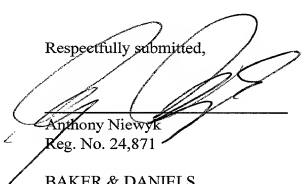
By the present Preliminary Amendment, the claims have been revised to delete the need for multiple dependency.

Care has been taken so as to avoid the addition of new matter in the specification, claims and abstract.

Entry of the present Preliminary Amendment prior to the examination of the application is respectfully requested.

In the event applicant has overlooked the need for an extension of time, an additional extension of time, payment of fee, or additional payment of fee, applicant hereby petitions therefor and authorizes that any charges be made to Deposit Account No. 02-0385, Baker & Daniels.

Respectfully submitted,

  
Anthony Niewyk  
Reg. No. 24,871

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Changes Made to Claims

Claim 1 remains unchanged.

Claim 2 remains unchanged.

Claim 3 has been amended as follows:

3. (Amended) Wind machine as claimed in [any one of claims 1 and 2] claim 1, characterised in that the aerodynamic nose (20) is provided with a wind inlet orifice (35) communicating, on the one hand, with a water-separating enclosure (37) and, on the other hand, with ducts (38, 39) for guiding air cooling the electric power circuits.

Claim 4 has been amended as follows:

4. (Amended) Wind machine as claimed in [any one of claims 1 to 3] claim 1, characterised in that at its upstream end contiguous with the rotating hub (7), the hood (9) is extended by a gutter (40) penetrating the interior of the latter to collect rain water.

Claim 5 remains unchanged.

Claim 6 remains unchanged.

Claim 7 has been amended as follows:

7. (Amended) Wind machine as claimed in [any one of claims 5 and 6] claim 5, characterised in that the upstream end of the hood (9) contiguous with the rotating hub (7) is

extended by a gutter (40) penetrating the interior thereof for collecting rain water.

Claim 8 remains unchanged.

Claim 9 remains unchanged.

Claim 10 remains unchanged.

Claim 11 remains unchanged.

Claim 12 has been added as follows:

12. Wind machine as claimed in claim 2, characterised in that the aerodynamic nose (20) is provided with a wind inlet orifice (35) communicating, on the one hand, with a water-separating enclosure (37) and, on the other hand, with ducts (38, 39) for guiding air cooling the electric power circuits.

Claim 13 has been added as follows:

13. Wind machine as claimed in claim 2, characterised in that at its upstream end contiguous with the rotating hub (7), the hood (9) is extended by a gutter (40) penetrating the interior of the latter to collect rain water.

Claim 14 has been added as follows:

14. Wind machine as claimed in claim 3, characterised in that at its upstream end contiguous with the rotating hub (7), the hood (9) is extended by a gutter (40) penetrating the interior of the latter to collect rain water.

Claim 15 has been added as follows:

15. Wind machine as claimed in claim 6, characterised in that the upstream end of the hood (9) contiguous with the rotating hub (7) is extended by a gutter (40) penetrating the interior thereof for collecting rain water.

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## DEMANDE INTERNATIONALE PUBLIÉE EN VERTU DU TRAITE DE COOPERATION EN MATIERE DE BREVETS (PCT)

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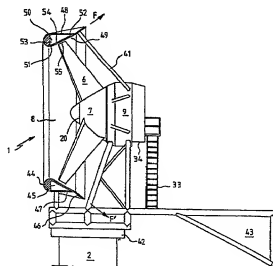
(57) Abstract

A wind machine which is mounted on a vertical mast (2) which cooperates with a propeller (1) which is actuated by the wind and cooperates with an alternator in order to provide electric power. The propeller (1) is fitted with slanted blades (6) which are supported by a large-diameter hub (7) with a horizontal axis and whose generators are located along the trunk of the cone facing the wind. The invention is characterized in that the alternator comprises a magnetic rotor (4) which is fixed to the hub, preferably at a maximum diameter, in addition to a magnetic coil stator (5) which is adjacent to the rotor (4), according to a partial or total crown and fixed to a fixed frame (22) which is joined to a revolving hood (9) extending the hub (7) coaxially thereto. The invention is further characterized in that the blades (6) are surrounded close to the ends thereof (55) by a divergent and relatively short circular fairing (8) which is concentrically mounted with respect to the hub (7).

(57) Abrégé

Bolienne montée sur un mât vertical (2) et comportant une hélice (1) actionnée par le vent et coopérant avec un alternateur pour fournir de l'énergie électrique, cette hélice (1) étant équipée de pales obliques (6)

portées par un moyeu (7) de gros diamètre, d'axe horizontal, et dont les génératrices sont situées le long d'un tronc de cône, face au vent, caractérisée en ce que l'alternateur comporte d'une part un rotor magnétique (4) fixé au moyeu (7) de préférence au niveau du diamètre maximal disponible et d'autre part un stator (5) à bobines magnétiques, adjacent au rotor (4), selon une couronne partielle ou totale, et fixé à un châssis fixe (22) solidaire d'un capot de révolution (9) prolongeant le moyeu (7), coaxialement à celui-ci; et les pales (6) sont entourées, à proximités de leurs extrémités (55), par un carénage circulaire divergent (8) de longueur relativement faible monté concentriquement au moyeu (7).



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### Wind machine with slanting blades

The present invention relates to a wind machine mounted on a vertical mast having a wind-driven turbine co-operating with an alternator in order to generate electric power.

For a long time, specialists have been seeking to capture wind energy, which has the advantage of being clean, i.e. it does not cause thermal or chemical pollution, and at the same time renewable.

However, these advantages are to a large extent offset by a series of disadvantages, in particular related to the disperse and intermittent nature of wind; moreover, it is known that wind "farms" require a lot of space and can not operate without generating a noise nuisance.

As a result of these disadvantages, the market for wind machines has not taken off as one might have expected over the last few years and the potential for development in this field still remains enormous.

More specifically, the wind machines which are currently used are usually fitted with turbines having radial blades on a horizontal shaft similar to those used to propel aircraft, but generally speaking much larger. Such turbines conventionally co-operate with industrial dynamos or alternators having variable speed drives, which make them heavy, expensive and low in output.

The use of turbines with a vertical shaft and vertical blades, known as "panemones" has been proposed because they have the advantage of being less expensive and do not depend on specific members being positioned

facing the wind but their output is mediocre.

In both of these systems, the blades are fragile and are subjected to vibrations and resonance, which causes breakage due either to fatigue or to gusts of wind; being  
5 inadequately protected, these members can therefore be very dangerous.

A third type of wind machine has been described in theory in various publications but not used on an industrial scale and has slanting blades extending from  
10 a large hub, the generators of which are located along the trunk of a cone facing the wind. The latter drives the blades in rotation and is guided by a diffuser unit comprising the hub, the blades and, in some cases, a concentrically mounted fairing surrounding the ends of  
15 the latter.

In a system of this type, the air flow is divergent, which enables extra speed to be generated in line with the blades and increases the amount of energy transmitted; in addition, the slanting blades are longer  
20 than radial blades of the same effective diameter and are active across their entire length without any terminal aerodynamic loss, which increases output still further.

Wind machines of this type are described in publications US-4 781 523, DE-804 090 or FR-2 627 812,  
25 for example.

Mention should also be made of another wind machine, known from document FR-2 763 759, with an electric generator, the rotor of which is linked to a fairing which joins the ends of the blades to one another, hence  
30 at the point of their maximum diameter; a wind machine of this same type had previously been described in document

US-1 352 960: this wind machine has a peripheral rim bearing inductor magnets and constituting a rotor positioned facing a group of three laminated magnetic poles on which electric conductors supplied with current are wound in order to provide a stator outside the rotor.

Document FR-967 895 proposes large-diameter electrical machines with vertical shafts, in which the inductor rotor and the induced stator are disposed along flat rings, either of the same dimension one on top of the other or one inside the other; in either case, the rotor is mounted and guided by means of a circular roller track matching a horizontal rail fixed to the ground or on a pylon and on which rollers linked to the rotor run.

The electric generators disclosed by these publications are very cumbersome and heavy and therefore require expensive mounting structures and pylons.

The objective of the present invention is to overcome these disadvantages by proposing a more robust wind machine, which is less cumbersome but of the same power and less noisy than the wind machines proposed to date.

This wind machine has a wind-driven turbine fitted with blades borne on a large-diameter hub on a horizontal shaft.

In accordance with the invention, a wind machine of this type is characterised in that it is fitted with an alternator comprising, firstly, a magnetic rotor secured to the hub, preferably on a level with the maximum available diameter, and, secondly, a stator with magnetic coils, adjacent to the rotor, disposed in a partial or full circle, and secured to a fixed frame joined to an

encircling hood mounted coaxially with and extending the hub to form a streamlined casing in which the alternator is housed.

5 The rotor is preferably provided with permanent magnets, regularly distributed in a circle.

Accordingly, in a particularly advantageous manner, the gears and speed drives linked to the generators in commercial use to date can be dispensed with, offering a high-power wind machine that is directly driven.

10 By virtue of a preferred feature of the invention, the internal part of the hub is provided with a flat ring having a horizontal axis, coinciding with the axis of rotation, the lateral faces and/or internal or external peripheral edge of which co-operate with groups of runner  
15 wheels with fixed shafts joined to the frame so as to define a retaining and guide rail during rotation.

As a general rule, the groups of runner wheels are runners made from metal or coated with hard plastics, of the type used on conveyors or warehouse trolleys. Between  
20 them, these wheels retain the flat ring at various points around its periphery; their distribution will, of course, depend on how much force is required and more will therefore be provided at the top and bottom as needed.

However, it should be pointed out that significantly  
25 fewer groups of wheels are needed than is the case with the prior art designs described above where a non-rotating rail is used, thereby incurring a considerable gain for the rotating masses.

In accordance with another feature of the invention,  
30 the flat ring co-operates with braking means of the disk brake type, disposed between the groups of runner wheels

in order to prevent the turbine from being driven at too high a speed.

By virtue of another feature of the invention, the rotating hub has a bell-shaped element fitted with the rotor at its larger diameter downstream part, contiguous with the hood, and an upstream part holding the bases of the blades.

In accordance with another feature of the invention, the upstream part of the bell-shaped element is extended by an aerodynamic nose, preferably covering the blade bases.

It should be noted that the hub fitted with its aerodynamic nose and the hood located in the extension thereof are designed to form a streamlined casing forming an integral part of the diffuser unit, thereby helping to optimise the flow of air across the turbine.

In accordance with the invention, the nose of the hub is preferably provided with a wind inlet orifice communicating on the one hand with a water-separating enclosure and on the other with air guide ducts cooling the electric power circuits.

In addition, the hood is preferably extended at its upstream end, contiguous with the rotating hub, by means of a gutter penetrating the interior thereof to collect rain water.

In accordance with another feature of the invention, the blades are helical blades, forwardly inclined at an angle of between  $30^{\circ}$  and  $45^{\circ}$  and dimensioned so that the swept diameter is approximately twice or four times that of the hub or hood.

Experience has shown that this design enables

maximum power to be obtained.

To render the wind machine proposed by the invention operational, it is naturally vital to equip it in a known manner with orientation members comprising a servo-  
5 mechanism coupled with a wind telltale to orient the turbine in the direction of the wind.

By virtue of another preferred feature of the invention, the blades are shrouded, in the region of their ends, by a relatively short, divergent, circular  
10 fairing, mounted concentrically with the hub.

This fairing suppresses the turbulence that causes noise and in particular co-operates with the hub and the turbine blades to create a diffuser unit to obtain optimum air suction conditions and hence drive the rotor  
15 in rotation.

In accordance with another feature of the invention, the fairing has a rounded leading edge followed by a thick fairing and a divergent thin trailing edge, preferably assisted by gussets distributed in radial  
20 planes.

This design produces dual air suction, namely a first suction in the direction of the wind from the upstream part of the turbine into the interior of the fairing and between the blades and, on the other hand, a  
25 second suction created at the downstream part of the turbine from threads of air accelerated on a level with the trailing edge.

The fairing proposed by the invention preferably consists of a hollow beam with a substantially triangular  
30 section.

A fairing of this type may be displaced in rotation,

borne by the blades, depending on the circumstances.

However, by virtue of another feature of the invention, the latter is preferably a stationary element, mounted on arms joined to the frame and co-operating with  
5 the blade ends at a slight clearance.

It may be of advantage to provide an abrasive coating on the face of the fairing directed towards the blades, to deal with accidental contact with the ends of  
thereof.

10 The characterising features of the wind machine proposed by the invention will be described in more detail with reference to the appended drawings, of which:

- figure 1 is a perspective view of the turbine, with a fairing,
- 15 - figure 2 illustrates a first embodiment of the wind machine, seen in axial section,
- figure 3 is a partial front view of this first embodiment,
- figure 4 is a partial view in axial section of a second, preferred embodiment of the invention,
- 20 - figure 5 is a partial view seen from the downstream end of figure 4,
- figure 6 is a detailed view in axial section of the wind machine illustrated in figure 4,
- 25 - figure 7 shows a detail from figure 6, illustrating the flat ring and a group of runner wheels,
- figure 8 illustrates a view in section of a variant of the wind machine illustrated in figures 4 to 7.

As schematically illustrated in the drawings, the  
30 wind machine has a turbine 1 which is mounted on a mast 2 and co-operates with an alternator comprising a rotor



4 and a stator 5 to generate electricity.

Although not illustrated in the drawings, the rotor 4 is a rotor with permanent magnets regularly distributed in a circle whilst the stator 5 is a stator with magnetic coils, adjacent to the rotor 4, distributed in a partial or full circle.

In addition and as illustrated in the drawings, the turbine 1 is fitted with helical blades 6, inclined towards the upstream end in the direction V of the wind, the generators of which are located along the trunk of a cone.

These blades 6 are borne by a large-diameter hub 7 with a horizontal axis and are surrounded in the vicinity of their ends by a relatively short, divergent, circular fairing 8, which is mounted concentrically with the hub 7.

The rotor 4 is secured to the hub 7 on a level with the maximum available diameter.

The stator 5 is joined to an encircling hood 9, mounted coaxially with and extending the hub 7 to form a streamlined casing.

As illustrated in figure 2, the blades 6 are fixed to the hub 7, which rotates about runners 10, 11 borne by a fixed shaft 12. Downstream in the direction V of the wind, the latter is supported by a diametrically profiled bar 13 supporting the fairing 8, which co-operates with the ends of the blades at a slight clearance.

The latter are also joined to one another by a conical ring 14.

In another variant not illustrated in the drawings, the turbine 1 is not fitted with a fairing and the

conical ring 14 is slightly larger at the requisite point to create the divergence for the air flow.

Furthermore, as illustrated in figure 2, the diametric bar 13 bears an oblique bracket 15 which helps to provide downstream support for the fixed shaft 12 and the stationary hood 9 extending the rotating hub 7.

The resultant unit is mounted so that it can be oriented at the top end of the mast 2 by means of a bearing 16 with a vertical axis so that the wind machine can be positioned facing the wind.

As illustrated in figure 6, the hub 7 essentially consists of a bell-shaped element 17 provided with oblique cells 18 retaining the ends of spars 19 inside the blades 6, which are therefore secured on a level with their bases.

The upstream part of this element 17 having a smaller diameter is provided with an aerodynamically shaped conical nose 20 located in the extension thereof and its downstream part having a larger diameter is extended by the stationary encircling hood 9 joined to the stator 5; the unit comprising the hub 7, the aerodynamic nose 20 and the encircling hood 9 thus form a streamlined casing, more clearly illustrated in figure 4.

Furthermore, as illustrated in figures 6 and 7, the downstream part of the bell-shaped element 17 is provided with a flared edge 21, defining an annular collar, the internal periphery of which bears the rotor 4.

The stator 5 is in turn secured facing the rotor 4 and inside the latter on a frame 22 of mechanically welded sections; the encircling hood 9 coaxially

extending the hub 7 is also secured to the frame 22.

The stationary frame 22 is also joined to other members of the wind machine, such as a bracket 32 for hoisting up construction or maintenance equipment, and the mast 2.

As illustrated in figure 4, a ladder 33 facilitates access to the internal part of the hood 9, which has a cut-out at 34 to allow this equipment to be hoisted through.

As illustrated in figures 6 and 7, the internal part of the bell-shaped element 17 is also provided with a flat ring 23 secured thereto by means of bolts 24 (figure 7) and defining a retaining and guide rail of the hub 7 during rotation.

This flat ring 23 has two lateral faces 25, 25' and an internal peripheral edge 26 on which groups of runner wheels distributed at various points around its periphery run.

More specifically and as illustrated in figure 7, each of the groups of runner wheels has, on the one hand, a runner wheel 27 on a horizontal shaft 28 which runs on the internal peripheral edge 26 of the ring 23 and, on the other hand, two runner wheels 29, 29' with radial shafts 30, 30' which guide the respective lateral faces 25, 25' of the ring 23 retaining a slight clearance in order to keep it in its plane of rotation.

The shafts 28, 30, 30' of the runner wheels 27, 29, 29' are also fixed to the frame 22 supporting the stator 5 and the encircling hood 9.

As illustrated in figure 6, the flat ring 23 is also under control of braking means 31 of the disk brake type,

disposed between the sets of runner wheels 27, 29, 29'.

Figure 6 illustrates the aerodynamic nose 20 of the hub 7, which has an air inlet orifice 35 at its axial part, linked via a substantially horizontal duct 36 to a water-separation box 37; water can therefore be discharged downwards in the direction of arrow f. The water-separation box 37 also communicates with cooling ducts 38 which convey fresh air to the electric circuits of the alternator 4, 5 via pipes 39.

As illustrated in more detail in figure 8, the wind machine is also provided with a guttering 40, which extends the encircling hood 9 inside the rotating hub 7 in order to collect rain water and discharge it downwards.

As illustrated in figures 4 and 5, the fairing 8 is secured to the fixed frame 22 by means of arms 41 inclined towards the upstream end, which pass through the encircling hood 9.

The turbine 1 configured as explained above is mounted at the top of a mast 2 by means of an orientation bearing, the housing 42 of which is linked to a servo-mechanism coupled with a wind telltale, not illustrated, mounted downstream on a structure 43 to enable the turbine 1 to be positioned facing the wind.

As illustrated in figures 1 and 4 (which shows a view in section), the fairing 8 co-operates with the ends 55 of the blades 6 at a slight clearance therefrom; it has a rounded leading edge 44 followed by a thick fairing 45 and a divergent, thin trailing edge 46 assisted by gussets 47 distributed in radial planes.

This configuration creates a divergence for the air

flow downstream, in the direction of arrows F and F'.

As illustrated in figure 4, the fairing 45 is made from a hollow beam with a substantially triangular cross section. More specifically, this beam has a substantially  
5 rectilinear external face 48 and a rounded internal face 49.

In addition and in a variant of the embodiment illustrated in figure 8, the positions of the rotor 4 and the stator 5 may be reversed so that the rotor 4 is  
10 located inside the stator 5.

A design of this type facilitates the operations involved in mounting and dismantling the stator 5, which is made from individually demountable sections which can be manipulated by means of a pulley system, not  
15 illustrated, hooked onto the bracket 32.

In this design, the runner wheels 27, 29, 29' of the flat ring 23 are retained by a seat 56 secured to the frame 22, the wheel 27 with the horizontal shaft being shown slightly to the rear of the section illustrated in  
20 the diagram. It runs on the external peripheral edge 57 of the ring 23.

### CLAIMS

1) Wind machine mounted on a vertical mast (2) and having a wind-driven turbine (1) which is fitted with blades (6) mounted on a large-diameter hub (7) with a horizontal axis, and an alternator co-operating with the turbine (1) to generate electrical power and which is provided on the one hand with a magnetic rotor (4) fixed to the hub (7), preferably on a level with the maximum available diameter, and on the other hand a magnetic coil stator (5) adjacent to the rotor (4) and secured to a stationary frame (22) joined to an encircling hood (9) extending the hub (7) coaxially to form a streamlined casing in which the alternator is housed, characterised in that the upstream part of the hood is extended by an aerodynamic nose (20) joined therewith in rotation which preferably shrouds the bases of the blades (6) and its downstream part is extended by the stationary encircling hood (22) joined to the stator (5).

2) Wind machine as claimed in claim 1, characterised in that the rotating hub (7) has a bell-shaped element (17), the downstream part (21) of which having the larger diameter contiguous with the hood (9) is fitted with the rotor (4) and the upstream part of which retains the bases of the blades.

3) Wind machine as claimed in any one of claims 1 and 2, characterised in that

the aerodynamic nose (20) is provided with a wind inlet orifice (35) communicating, on the one hand, with a water-separating enclosure (37) and, on the other hand, with ducts (38, 39) for guiding air cooling the electric power circuits.

4) Wind machine as claimed in any one of claims 1 to 3, characterised in that at its upstream end contiguous with the rotating hub (7), the hood (9) is extended by a gutter (40) penetrating the interior of the latter to collect rain water.

5) Wind machine mounted on a vertical mast (2) and having a wind-driven turbine (1) which is fitted with blades (6) mounted on a large-diameter hub (7) with a horizontal axis, and an alternator co-operating with the turbine (1) to generate electrical power and which is provided on the one hand with a magnetic rotor (4) secured to the hub (7), preferably on a level with the maximum available diameter, and on the other hand a magnetic coil stator (5) adjacent to the rotor (4) and secured to a stationary frame (22) joined to an encircling hood (9) extending the hub (7) coaxially to form a streamlined casing in which the alternator is housed,

characterised in that the internal part of the hub (7) is provided with a flat ring (23) having a horizontal axis coinciding with the axis of rotation, the lateral faces (25, 25') and/or the internal (26) or external (57) peripheral edge of which co-operate with groups of runner wheels (27, 29, 29') having fixed shafts joined to the frame (22) to define a

retaining and guide rail during rotation.

6) Wind machine as claimed in claim 5,  
characterised in that

- 5 the flat ring (23) co-operates with braking means (31) of  
the disk brake type disposed between the groups of wheels  
(27, 29, 29').

- 10 7) Wind machine as claimed in any one of claims 5 and 6,  
characterised in that  
the upstream end of the hood (9) contiguous with the  
rotating hub (7) is extended by a gutter (40) penetrating  
the interior thereof for collecting rain water.

- 15 8) Wind machine mounted on a vertical mast (2) and having  
a wind-driven turbine (1) which is fitted with blades (6)  
mounted on a large-diameter hub (7) with a horizontal  
axis, and an alternator co-operating with the turbine (1)  
to generate electrical power and which is provided on the  
20 one hand with a magnetic rotor (4) secured to the hub  
(7), preferably on a level with the maximum available  
diameter, and on the other hand a magnetic coil stator  
(5) adjacent to the rotor (4) and secured to a stationary  
frame (22) joined to an encircling hood (9) extending the  
25 hub (7) coaxially to form a streamlined casing in which  
the alternator is housed,  
characterised in that

- the ends (55) of the blades (6) are shrouded by a  
relatively short, divergent, circular fairing (8),  
30 mounted integrally therewith and concentrically with the  
hub (7).



9) Wind machine mounted on a vertical mast (2) and having a wind-driven turbine (1) which is fitted with blades (6) mounted on a large-diameter hub (7) with a horizontal axis, and an alternator co-operating with the turbine (1) to generate electrical power and which is provided on the one hand with a magnetic rotor (4) secured to the hub (7), preferably on a level with the maximum available diameter, and on the other hand a magnetic coil stator (5) adjacent to the rotor (4) and secured to a stationary frame (22) joined to an encircling hood (9) extending the hub (7) coaxially to form a streamlined casing in which the alternator is housed, characterised in that

the blades (6) are shrouded in the vicinity of their ends (55) by a relatively short, divergent, circular fairing (8) mounted concentrically with the hub (7) and comprising a stationary element mounted on arms (41) joined to the frame (22) and co-operating with the ends (55) of the blades (6) at a slight clearance therefrom.

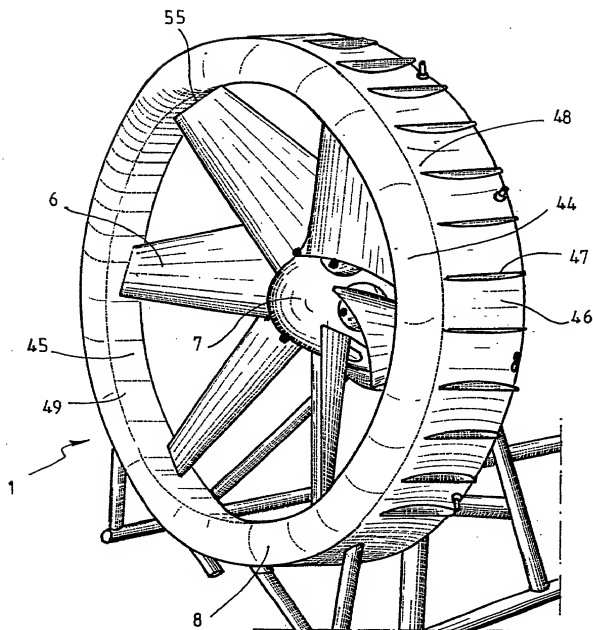
10) Wind machine as claimed in claim 9, characterised in that

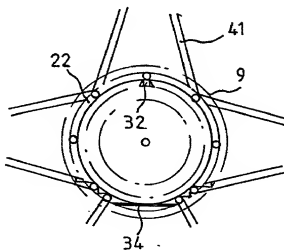
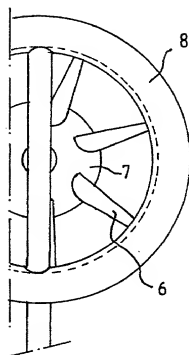
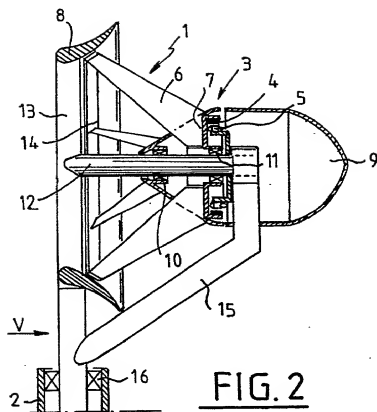
the fairing (8) has a rounded leading edge (44) followed by a thick fairing (45) and a divergent, thin trailing edge (46).

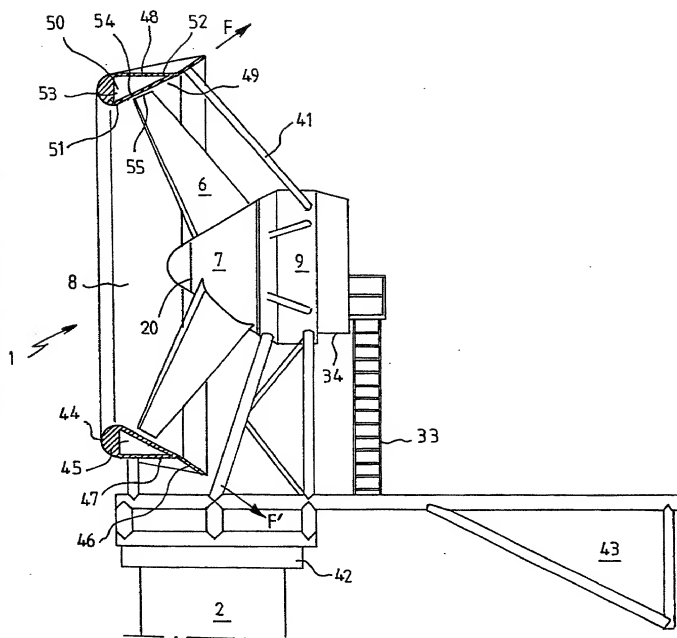
11) Wind machine mounted on a vertical mast (2) and having a wind-driven turbine (1) which is fitted with blades (6) mounted on a large-diameter hub (7) with a horizontal axis, and an alternator co-operating with the

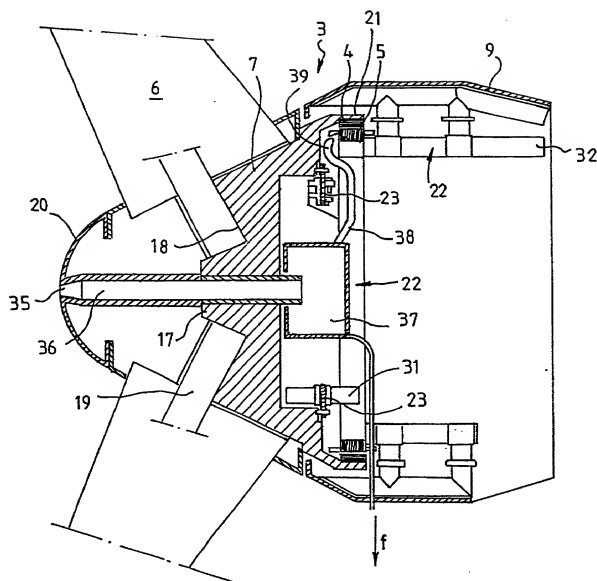
turbine (1) to generate electrical power and which is provided on the one hand with a magnetic rotor (4) secured to the hub (7), preferably on a level with the maximum available diameter, and on the other hand a  
5 magnetic coil stator (5) adjacent to the rotor (4) and secured to a stationary frame (22) joined to an encircling hood (9) extending the hub (7) coaxially to form a streamlined casing in which the alternator is housed,

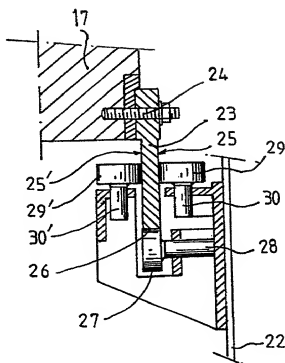
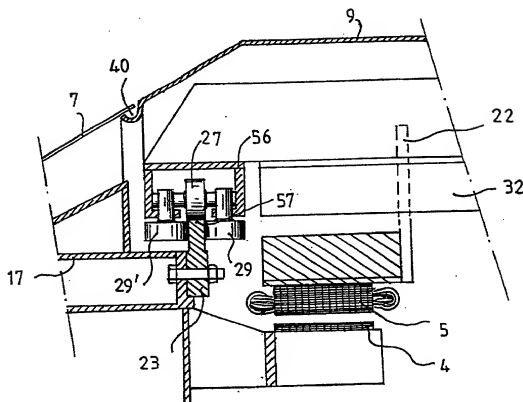
- 10 characterised in that  
the blades (6) are helical blades inclined towards the upstream end at an angle of between  $30^{\circ}$  and  $45^{\circ}$  and dimensioned so that the swept diameter is approximately twice or four times that of the hub (7) or the hood (9).

FIG. 1



FIG. 4

FIG. 6

FIG. 7FIG. 8

ATTORNEY'S DOCKET NO. HEX0046

**PCT/USA NATIONAL DECLARATION AND POWER OF ATTORNEY  
FOR U.S. PATENT APPLICATIONS  
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
UNDER 35 U.S.C. SECTION 371(c)(4)**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name:

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the invention described and claimed in international application No. PCT/FR99/02705 entitled: WIND MACHINE WITH SLANTED BLADES

and as amended on \_\_\_\_\_ (if any), which I have reviewed, and I understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above and for which I solicit a patent; that I do not know and do not believe that this invention was ever known or used in the United States of America before my or our invention or discovery thereof, or patented or described in any printed publication in any country before my or our invention or discovery thereof, or more than one year prior to my international application; that this invention was not in public use or on sale in the United States of America for more than one year prior to my international application; that this invention has not been patented or made the subject of an inventor's certificate issued before the date of my international application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months before my international application; that I acknowledge my duty to disclose information of which I am aware which is material to patentability of this application; and that prior to filing said international application, applications for patent or inventor's certificate on this invention of discovery which have been filed by me or my legal representatives or assigns in any country foreign to the United States of America are as follows:

(a) none filed more than 12 months prior to said international application, unless named below:

(b) earliest filed less than 12 months prior to said international application (the priority of which is hereby claimed under 35 U.S.C. Section 365):

FR9906076 filed May 12, 1999

I hereby claim the benefit under Title 35, United States Code, §120, of any United States application(s) listed below and insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, Code of Federal Regulations, §1.56, which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.)

(Filing Date)

(Status)(patented, pending, abandoned)

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I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

The undersigned hereby authorizes the U.S. attorney or agent named herein to accept and follow instructions from \_\_\_\_\_ as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney or agent and the undersigned. In the event of a change in the persons from who instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned.

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